

A Multicountry Analysis of the Impact of Unwantedness and Number of Children on Child Health and Preventive and Curative Care

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**A multicountry analysis of the impact of unwantedness
and number of children on child health and preventive and curative care¹**

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Abstract

The post-Cairo justification for family planning is that lower fertility, including fewer unwanted births, leads to better health outcomes for women and children. This paper investigates that claim. We use data from eleven countries and one large Indian state. Considerable evidence was found of worse health outcomes among unwanted children and less treatment for sick children in larger families. The effects were quite large: unwanted children are between 10% and 50% more likely to become ill than are wanted children and having one more sibling decreases the likelihood of receiving treatment by from 2% to 8% of the average level of treatment.

A multicountry analysis of the impact of unwantedness and family size on child health and preventive and curative care

Increasingly, family planning programs are justified in terms of their health benefits for women and children (e.g. United Nations Development Program 1994). The provision of family planning services allows couples to have fewer births, to time these births, to space them, and to have fewer unwanted births, which improves the health of women and children. By inference, investments in family planning programs are expected to generate benefits for health. The argument underlying the connection between number, spacing and timing of children and subsequent child health assumes relatively fixed resources available to the family. If a couple have more children, or if they come early in a marriage or are closely spaced, the fixed biological and economic resources of the couple must be divided among more family members with a smaller share going to each. Thus poorer health outcomes result.

However, this key link in the justification for family planning programs has been challenged. It has been argued that resources are not fixed: parents may reduce their consumption in favor of their children; older siblings may work and increase family resources; larger kin groups can share the cost of child rearing so that there is no impact of the number of siblings on a child; and health and education may be publicly provided, so number of children is unimportant. Finally, some have argued that although there may be some effect of number of children, only some children may be affected because parents can influence resource allocation to the advantage of more-favored children (often males); or such a trade-off between the number of children and their health and education does not occur at lower levels of economic development but emerges only as development provides the means for families to affect child health and

education, and as returns to investments in childrens' human capital increase (King 1987; Lloyd 1994; Desai 1992 1995; Kelley 1996).

A further issue is that morbidity and mortality may have important feedback links to fertility. For example, a recent study of mortality and fertility in India concluded that "the direct promotion of child health ...is likely to be more conducive to lowering fertility than are indirect interventions based on promoting economic development" (Muthi, Guio, and Dreze 1995:772). In a recent survey of fertility and mortality in developing countries, Cleland (1998:34) concluded that: "mortality decline is the common underlying cause of third world fertility transitions." If declines in child morbidity and mortality do in fact lead to lower fertility, then an understanding of factors influencing child health has importance beyond the direct benefits to the welfare of women and children discussed above. It may suggest interventions that hasten the decline of fertility.

The post-Cairo justification for family planning programs is then that family planning programs lower fertility, and lower fertility, in turn leads to better health outcomes for women and children. In addition, family planning leads to fewer unwanted births by helping women achieve their reproductive goals (Bongaarts 1997a) and fewer unwanted births also lead to better child health outcomes. This study investigates the second part of the causal chains. That is, are lower fertility and less unwantedness associated with better health outcomes? The answers to these questions are of significant policy importance apart from their role as justifications for family planning programs.

Past Research

Most work on within-household impacts of large family size has focused on the average well-being of children within families, examining for example, differences in average educational attainment of children as a function of number of siblings (sibsize). One of the strongest impacts of sibsize on average educational attainment by children is found in the work of Knodel, Havanon, and Sittitrai (1990) for Thailand. Other studies based on essentially similar conceptions of within-family allocation include those of Bauer et al. (1992) and DeGraff et al. (1993) for the Philippines, Behrman and Wolfe (1987) for Nicaragua, and Rosenzweig and Wolpin for India (1980). All of these authors find that children from large families receive less education than do children from smaller families. The effects are often small, and causality is difficult to infer.

A more recent literature has investigated the effect of number of children on child health and mortality. For example, Desai (1995) found that in 11 of the 15 countries she studied, having more younger siblings decreased a child's health because of increased competition for resources. She found that in only three countries did the presence of older siblings improve the health of younger children, possibly because they added to family resources. Garg and Morduch (1996) found strong support for resource constraint effects on child health in Ghana. They concluded that eliminating child rivalry for resources would improve health by at least 20% to 30% in some families. Desai (1992, 1995) and Lloyd (1994) argued that sibsize effects are more likely to be present if public provision of health services is low, child costs are not spread through social arrangements such as fostering, and occur later in the process of economic development as the costs of children rise. Desai (1995) found that the impact of sibsize on health

was smaller in countries where there was greater government assistance to agriculture (a measure of public attitudes to individual food consumption) but did not find a significant relationship between the impact of sibsize and a measure of child fostering. She also found some evidence for larger impact of sibsize as the level of economic development increased.

These negative associations between education and health and number of siblings reflects increasing competition amongst siblings for finite family resources decreasing average access to education and health. This is the “resource dilution” model associated with Judith Blake (1981). However, it is also plausible that parents with a preference for larger families are those who see less need to educate their children, and rather than reflecting a pure causal relationship, the correlation between family size and children’s educational attainment and health is based in part on all of them being a response to parental tastes and resource constraints (Becker and Lewis 1973).

The potential endogeneity of fertility in parents’ human capital decisions lies at the heart of reviewers’ criticisms of much of the work in the field (e.g. King 1987; Kelley 1996). When the model treats family size as endogenous, researchers tend to find small effects of family size on household resource allocation. For example, in an attempt to examine the impact of the purely exogenous component of fertility, Rosenzweig and Wolpin (1980) use a sample of twin births, and find a small impact of exogenous fertility on subsequent educational attainment in India. However, this study is limited by a very small sample size. Behrman and Wolfe (1987) use a sample of adult sisters towards similar statistical ends. However, not all researchers accept the assumption that all decisions concerning marriage, children, education and health are made at a single point in time. For example, DeGraff et al. (1993) assume that household decisions

regarding children's human capital are made sequentially and Montgomery et al. (1997) argue that a multiple decision period model is more realistic. If decisions are sequential, then sibsize is not endogenous. If one accepts that fertility is endogenous, then it appears that in some societies there are negative effects but they are often relatively small. If one does not accept endogeneity, then the effects are more common and larger.

While sibsize number of children is a potential measure of parents' ability to provide adequate care, it is very important to address what Scrimshaw (1978) and Caldwell (1979) refer to as parent's willingness to provide adequate care. Whether a child is wanted should serve as a proxy for parent's willingness to invest resources in a child. As Montgomery et al (1997) have argued, unintended fertility (an unwanted or mistimed birth) is an exogenous shock that imposes new and unanticipated demands on resources that were not planned for, displacing the parent's childbearing and rearing strategy from what would otherwise have been optimal. Unwanted fertility is widespread in developing countries. Lloyd (1994) reports that over 30% of births are unwanted in countries where the Total Fertility Rate (TFR) is between 4 and 6 children while only 16% are unwanted in countries with higher levels of fertility. Bongaarts (1997b) showed that average unwanted fertility rose 20% between the late 1970s/early 1980s and the early 1990s for 20 developing countries. He argued that desired family size declines early in the demographic transition leaving sexually active women at risk of an unwanted pregnancy for the majority of their reproductive lives. If effective family planning is not established women could have several unwanted births. Raising the level of contraceptive use among women motivated to avoid childbearing is the most obvious way to limit unwanted fertility (Bongaarts 1997b:31). Thus, as the percentage of unwanted births rises with the progress of the demographic transition, there is a

possibility of growing underinvestment in children attributable to excess fertility (Lloyd 1994:191- 192).

Despite the potentially important effects of unwantedness on children, there is a paucity of research, especially in developing countries. For Thailand, Frenzen and Hogan (1982) found that children wanted by both parents have a significantly higher probability of surviving their first year than do children wanted by only one or neither parent. Montgomery et al. (1997) examined the effects of unintended and excess fertility on health and mortality in five developing countries. They found that short birth intervals, which can reflect imperfect fertility control, increased the risk of post-neonatal mortality. Women in Egypt, the Philippines, and Thailand who reported excess fertility also had higher infant mortality and women in Dominican Republic with excess fertility had children with lower height for age. No effects of excess fertility on child nutritional status were found in the other four countries.

For education, Montgomery and Lloyd (1996) found large negative impacts on educational attainment in the Philippines and the Dominican Republic in families in which two or more unwanted births occurred over a five year period. Montgomery et al. (1997) found small negative impacts of excess fertility on educational attainment in all five developing countries they studied. Myhrman et al. (1995) reported results from Finland in which mothers were interviewed in the sixth or seventh month of their pregnancy and were asked whether the pregnancy was wanted, mistimed, or unwanted. These women were followed up 14 and 24 years later. Myrman et al. found that differentials in educational attainment by wantedness existed for daughters and for sons with two or more siblings. That sibsize mattered, even for sons, implied that resource constraints were increasingly important as sibsize grew. The findings of this study

are very important because the measure of wantedness is measured before the child was born and is not subject to post hoc rationalization. Thus we believe that unwantedness is a potentially important determinant of parents' investments in individual children. Previous studies that have ignored unwantedness have possibly identified negative effects of sibsize that are in fact due to the unwantedness of higher parity children. This possibility is illustrated by the fact that in the DHS data sets we employ, the correlation between unwantedness and number of children is generally between 0.35 and 0.50. In such a case, regression estimates of the impact of sibsize in a model which ignores unwantedness would overstate the impact of sibsize.

A more fully-developed strand in the literature examines differential allocations of family resources on the basis of an indirect measure of wantedness: the child's sex. This strand, like models tested using twin births, relies on the occurrence of exogenous events to identify resource- allocation decisions. In this instance, the birth of a girl is outside of parents' pre-conception decision making calculus. There is evidence that strong cultural preferences for sons in many developing countries, especially in South and East Asia, have resulted in direct female infanticide and unfavorable allocation of scarce resources and inferior health care for girls which leads to indirect infanticide (Ren 1995). Work by Chen et al. (1981), Simmons et al. (1982) and Dasgupta (1987) has shown that South Asian girls do receive less food than their male siblings, and are less likely to survive their childhood. The Simmons et al. work is noteworthy in demonstrating the strengthening effect of sibling competition for resources on the impact of a daughter's birth when that daughter is unwanted. Rosenzweig and Schultz (1982) tie this to unfavorable labor market outcomes for some Indian girls. A recent comprehensive analysis of data from all DHS surveys concluded that in certain countries in South-central Asia and in Northern Africa and Western Asia there are unexpectedly large numbers of deaths of girls

relative to boys (United Nations 1998). The study does not find systematic evidence for differential treatment for girls in terms of nutrition, vaccinations, or in curative care, except in South-central Asia and, perhaps, in parts of Northern Africa and Western Asia and in Latin America and the Caribbean for curative care (pages 8, 9, 10, and 14).

Other Determinants of Health and Health Care

Studies of child morbidity and the use of curative and preventive care have identified a number of factors that affect the incidence and treatment of disease that we must control for when we attempt to estimate the effects of number of children, unwantedness, and sex.

Parent's Education

It has been argued that education supplies women with the knowledge and skills to raise healthy children and higher income either through higher wages or selective mating. It may also alter their preferences and improve their position in intra-household relations in ways advantageous to their children's health (Caldwell 1979; Rosenzweig and Schultz 1982). Some studies, such as Thomas et al. (1991) find that indicators of mother's access to information explains nearly all of the education effect on child health. However, in a survey of data from 35 developing countries Cleland and van Ginneken (1988) concluded that about half of the overall education effect on mortality is accounted for by the economic advantage associated with education—higher income, access to pure drinking water and flush toilets, and superior quality of dwelling. Two other possible intervening variables, reproductive health patterns and more equitable treatment of daughters and sons, were found to play a minor role.

Although the focus of most studies has been mother's education, Gursoy (1994) pointed out that in some countries and societies father's education is as important as mother's education

in explaining child mortality differentials. Father's education may reflect class or status differences, easier access to health facilities and health-related knowledge, and less dependence on traditional views.

Age

Morbidity drops with the age of the child. For acute respiratory infections (ARI), children aged 0 to 2 have 4 to 9 infections per year and by school age they have 3 or 4 infections per year (Stansfield and Shephard (1993). Controlling for other variables, morbidity should decrease with the age of the mother as she accumulates more experience of child rearing.

Income or Wealth of the Household

Numerous studies in public health have found the both ARI and diarrhea prevalence to be positively associated with lower socioeconomic status which reflects lower income, lower parental education, inferior housing conditions, and adverse childcare practices (Stansfield and Shepard 1993; Martines, Phillips, and Feachem 1993). Research in economics has shown that income is an important determinant of health input decisions and health outcomes (Thomas 1994).

Household Amenities

The public health literature has emphasized the importance of effective excreta disposal and safe water supply in preventing diarrhea and other intestinal infections (Ofosu-Amaah 1991). Empirical support for the impact of clean water and excreta disposal is mixed. This lack of support may affect measurement problems in that respondents may say they have a flush toilet but it may lack a working water supply. In other cases there may be access to water but the benefits of clean water are observed when the water supply is piped inside the house.

Areal Prevalence of Disease

Children living in the same area share the same climate, physical environment, socioeconomic and cultural environment, the same health infrastructure, and are exposed to the same illnesses and diseases which are transmitted through normal patterns of contact. That is, some areas are inherently unhealthier than others and control disease less well than others. Thus children in these areas are more likely to become ill despite the allocation of parental resources to their health.

Prenatal Care

Ahmad, Eberstein, and Sly (1991) found that prenatal care reduced child mortality by providing mothers with knowledge about child health and by allowing early diagnosis of conditions likely to interfere with the birth of a healthy child. Frankenberg (1995) found that , in Indonesia, maternal clinics concentrate on services that deal directly with fetal development, birth, and infant health. She found that adding a maternity clinic to a village decreases the odds of infant mortality by almost 15%, in comparison to the risk before the clinic was added. Panis and Lillard (1995) investigated the impact of prenatal care on infant and child mortality in Malaysia. They found evidence of significant heterogeneity among mothers in both child health risk and the use of health inputs which influences the estimate of the impact of prenatal care.

Distance to a Health Facility

The literature generally finds that a greater the distance to a health facility decreases use of health care and increases mortality. The size of the impact is significantly reduced with the addition of family and community variables and with controls for the possible endogenous placement of facilities (Frankenberg1995).

Health Measures

We investigate five measures of health available in the DHS data sets: illness with fever or cough in the previous two weeks; illness with diarrhea in the previous two weeks; seeking of modern sector treatment for fever or cough; seeking modern sector treatment for diarrhea; and number of vaccinations received. Modern sector treatment means any treatment sought from a hospital, clinic, pharmacy, doctor, or a nurse. The two diseases are the most important of childhood diseases in the developing world. Acute Respiratory Infection (ARI) is the most frequent illness globally and is a leading cause of death in the developing world. ARI is responsible for 20% to 60% of all outpatient consultations for children, 12% to 45% of all inpatient admissions, and 25% to 30% of all deaths of children under five years of age (Stansfield and Shepard 1993). Diarrhea can lead to dehydration and early death or impaired growth and nutritional status among survivors reducing future labor productivity. Fogel (1994) has found that stunting is also an important predictor of death and morbidity in middle and later ages. Fully 36% of all deaths of children under age five years are associated with diarrhea (Martines, Phillips, and Feachem 1993:94)

In many developing countries there are active traditional sectors providing health care but it is not clear what resource commitment is entailed in their use nor how effective they are. Cleland and van Ginneken (1988:1363) found that the reasons for using traditional health practitioners were convenience, attitude of the service provider, and limited availability of drugs at health centers. The traditional health sector tended to be particularly strong where the modern sector was weak. We attempted an informal survey of health professionals in the Philippines to measure price and effectiveness of traditional cures, but met with little success. Consequently,

we have chosen to focus on treatment supplied by the modern sector. The presumption is that effectiveness differentials are known to some reasonable approximation by mothers, and that modern methods cost at least as much as traditional methods, if not more, and are less accessible. Therefore use of modern-sector treatments reflects greater willingness on the part of parents to seek out effective care and commit resources.

Many studies of health use anthropometric measures such as height for age, weight for age, or body mass index. These are good measures of child nutrition, which constitutes a large share of parents' expenditures on children. However, these measures are not available in many of the DHS surveys used in this study and so have not been used. An observable consequence of poor nutrition status is low resistance to disease. Disease incidence therefore is a potential indicator of nutritional status, although a statistically noisy one because of its inherent random component due to chance exposure to infection.

Estimation Issues

Reliability, Validity, and Endogeneity of Wantedness and Endogeneity of Number of children

The DHS surveys ask the mother "At the time you became pregnant with [name of child], did you want to become pregnant then, did you want to wait until later, or did you want no more children at all?" If the mother replied that she wanted to become pregnant when she did or later we classify that birth as "wanted", if she replied that she did not want more children, then we

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The survey questions on wantedness are widely thought to be subject to post-hoc rationalization and thus their reliability and validity are questioned. The direction of post-hoc rationalization is not clear, however. Knodel and Prachuabmoh (1973), for example, believe that

their Thai data on unwantedness understates the degree of unwantedness , as mothers are reluctant to say that a given child was in fact unwanted. Rosenzweig and Wolpin (1993), on the other hand, claim that their United States data show the opposite. On the basis of an undesirable outcome, such as an unhealthy baby, Rosenzweig and Wolpin claim that some women (perhaps as many as one-fourth) who wanted a birth before it occurred change their postpartum response to “unwanted”.

The DHS questions on wantedness are carefully worded to try and reduce ex post rationalization, and evidence from experimental studies in Peru and the Dominican Republic (Westoff, Goldman, and Moreno 1990) indicate that the emphasis on the mother’s feelings at the time of conception helps to reduce the problem (Montgomery et al. 1997). Williams, Sobieszczyk, and Perez (1996) studied the reliability of the “wantedness” question in a survey and qualitative follow-up in the Philippines. They found that the classification of children as wanted or unwanted was generally the same in the two matched surveys. In analyzing the responses to questions on fertility preferences in the same survey, Casterline, Perez, and Biddlecom (1997:178) concluded that “although consistency was less than one might hope for...the overwhelming majority of women provided the same answer on each of the three

Bankole and Westoff (1998) investigated consistency of responses on wantedness in Morocco. They found that 67% of responses were consistent, although only 38% of those reported as “unwanted” in 1992 were reported as “unwanted” in 1995. They take this to reflect ex post rationalization of births but that the wantedness variable is more reliable when collected close to the birth of the child.²

Some evidence on validity of the response on wantedness exists. Bankole and Westoff (1998) found that 74% of women either reported wanting more children in 1992 and a wanted birth in 1995 or wanted no more children and reported an unwanted birth in 1995. Pritchett (1994) found a high degree of congruence between reports of desired family size and the declaration that a birth was unwanted if it exceeded this size (the correlation was 0.98 for the 39 countries for which both measures were available). His econometric results led him to conclude that ex post rationalization is not an important issue.

Because of the debate about the potential endogeneity of wantedness, that is, that it may be influenced by the health status of the child, we explicitly investigate this possibility in our empirical work. We also investigated the possible endogeneity of number of children, that is, the possibility that parents jointly choose the number and health care of their children. To do this we generated instruments for wantedness and number of children using reduced form equations. Reduced forms for these variables are estimated and used to generate instruments for subsequent Hausman tests. All predetermined variables from the structural equations for illness and treatment, as well as years since first marriage, whether parents expected financial support or to live with their children in retirement, birth weight categories, and whether the reference birth was one of a multiple birth, are used as instruments in estimating the reduced-form equations. We then used the residuals from these equations to construct Hausman-Wu tests for exogeneity of wantedness and number of children in each of the morbidity and health care equations. In only one-third of cases were we able to reject the null hypothesis of exogeneity of either wantedness or number of children. In other words, we have little evidence that illness in the last two weeks or health care provision affects either wantedness or number of children. Thus, our regressions use the actual values of these variables. Desai (1995) also failed to reject the exogeneity of

sibsize in her multi-country study of child health.

Selection Bias

There are two possible selection biases that concern us: mortality selectivity and illness selectivity. By focusing on living children, we potentially exclude particularly vulnerable children and may underestimate the impact of unwantedness and number of children. We initially explicitly modeled both mortality and illness using the Heckman approach. We did not find any evidence for statistically significant mortality selection. A similar conclusion was reached by Desai (1995) in her comparative studies of health and, in related work, Pitt (1997) found only very small impacts of not including the self-selectivity of fertility in models of child mortality. The implication of finding no support for mortality selectivity is that had the children who in fact died survived, we would not predict the incidence of disease to be any greater among them than among the surviving children.

We estimate the determinants of treatment in two ways. The results we present are from a single-stage univariate probit equation, which does not account for the fact that children must first become ill in order to be treated. The ideal estimation technique would be a modified bivariate probit model, in which one of the variables acts as a selection criterion for observations used in predicting the other.³ However, bivariate normal likelihood functions are not always well-behaved, and as a result, convergence often proved quite difficult to attain⁴. As a compromise, in addition to our univariate probit model, we estimated a two-stage Heckman selection model, using illness as the selection criterion into a linear probability model for treatment. Linear probability models are consistent, but the Heckman estimator is well known to be sensitive to specification errors.^{5 6} When transformed to derivatives evaluated at sample

means, the simple probit gave similar results to the Heckman estimates, and subsequent discussion of the estimates generally applies to either formulation.

Multilevel Effects

Correlated observations can cause standard errors to be underestimated and, in non-linear models, parameter estimates to be biased and inconsistent.(Trussell and Rodriguez 1990). Such clustering could be at the level of the family or community. Children from the same family may share genetic factors, child care practices, and parental competence and resourcefulness in raising children. Children from the same community are exposed to the same health infrastructure, climate, physical environment, and socioeconomic and cultural setting, and are exposed to the same illnesses and diseases which are transmitted through normal patterns of contact.

Most studies of clustering have focused on child mortality. Clustering does exist but some is due to observable factors and some to unobservable factors. For instance, Guo (1993) found that clustering of mortality in families in Guatemala was explained by a household's economic status and mother's education. Sastry (1997) found the same in Brazil. He concluded that this finding probably generalizes to other settings if parental competence and family genetics are truly independent from measured household characteristics and if accurate indicators of household's economic status are available.⁷

We do not feel that clustering at the household level presents a major problem in our case. First, the majority of our observations have no siblings young enough to be included in our data set. So, if correlations in health and treatment exist, they affect a relatively small number of observations. Second, we control for mother's education and household wealth which have been found to explain most of the family level clustering in mortality and, arguably, would explain

more of such clustering in illness and treatment. Third, it is possible that unwantedness may explain some of the clustering previously observed and we control for it here. Clustering within communities is a possibility. We have chosen to deal with this directly by constructing a variable that measures the risk of a specific illness in the child's community. This is the proportion of all children in the community, except the reference child, who are reported to be ill with the disease. This variable should capture the impact of common elements of health infrastructure, climate, geography, and socioeconomic and cultural setting. Because our models include possible simultaneity and sample selection and simultaneous multilevel models with selection were not available at the time of writing, we have not estimated such multilevel models.⁸ We did, however, estimate models with a random effects estimator that controls for clustering but does not allow us to distinguish between family level and community level effects. The significance of the community level risk of illness was reduced appreciably, although it was still statistically significant. The coefficients and standard errors of the other variables were unaffected. Thus, although some clustering of illness may be present in the data, it is empirically unimportant.

The Endogeneity of Prenatal Care

We include whether a mother used prenatal care primarily to control for unobserved heterogeneity among mothers in their "taste" for health. This approach is supported by the empirical findings of Panis and Lillard (1994). However, we cannot reject the possibility that a causal interpretation can be placed on this variable, as it often is in the public health literature. It is possible that a woman may attend a prenatal clinic, perhaps on the recommendation of a friend, and learnt about health care practices that lead her to take her child for treatment should that child become ill.

Seasonality

Since the DHS surveys were fielded in different months in different countries, it is possible that the seasons differ. This is relevant because it is possible that household resource constraints may be binding in the lean season but not in the surplus season. Thus if wantedness and number of children affect health, they may do so in the lean season but not in the surplus season when resources are more plentiful. Thus a failure to identify a significant effect may reflect seasonality. Wang (1997) found that while later-born children in Zambia have poorer health in both seasons, the size of the effect is reduced by 50% in the surplus season. Gender differences in the effects of parental incomes that are significant during the lean season diminish for fathers and disappear for mothers during the surplus season. In addition, she found that the impact of father's education is significant only in the lean season indicating that fathers may increase their involvement in household decisions in the lean season. Thus, we may underestimate the effects of unwantedness and number of children in those countries in which the survey was carried out in the surplus season.

The Model

We construct a model based upon the concept of a child-specific index of "child value", or parents' willingness to commit resources to a particular child. This index is posited to be a function of exogenous individual, household and community variables. Household resource commitments are measured directly by usage of health care, with associated monetary, time and other costs; and indirectly by the incidence of morbidity.

Define Z to be the index value for a given child, where, for X a vector of family and child-specific values, such as age, educational attainment and wealth holding, w a scalar index of

wantedness, and s a scalar count of number of children, so that

$$(1) Z = f(X, w, s)$$

Define A to be a vector of variables measuring family access to health care, and R to be a vector measuring risks of illness. Then the following conditions characterize the incidence of illness, curative care, and preventive care for living children:

$$(2) \text{ Illness observed : } I = 1 \text{ if } Z_1^* \geq Z / X, w, s, R$$

$$(3) \text{ Treatment observed : } T = 1 \text{ if } Z_2^* \leq Z / X, w, s, A, I = 1$$

$$(4) \text{ Preventive care observed : } V = 1 \text{ if } Z_3^* \leq Z / X, w, s, A$$

where Z^* denote unobserved threshold variables. Illness occurs if the index of child value, conditioned on child and family specific covariates and risks of illness, falls below an unobserved threshold value, and curative treatment occurs if child value, conditioned on access, covariates and illness, exceeds a minimum (unobserved) threshold. Preventive care is much like curative care, though not conditioned on illness. The presumption is that all else constant, wantedness is associated with decreased odds of illness and increased odds of curative and preventive treatment, while number of children is assumed to work in the opposite direction. Family-level covariates associated with increased wealth, income, or socioeconomic status are expected to exert a similar effect to wantedness, and increases in accessibility and risk are presumed to increase the odds of treatment and illness, respectively.

Data and Results

Data

We use data from eleven DHS surveys and one Indian state. The DHS surveys are Bangladesh 1993, Egypt 1992, Egypt 1995, Indonesia 1991, Indonesia 1994, and the most recent surveys from Kenya, Mali, Nepal, Peru, the Philippines, and Tanzania. We employ Uttar Pradesh data from the National Survey of Family Health⁹. The criteria for selection were geographic diversity and sample size¹⁰. We have also chosen countries at different stages of economic and demographic development and with different levels of public provision of health services, and different childrearing practices to assess the generality of our results. In our samples, the data have been transformed so that the live birth constitutes the unit of observation. Each has associated with it individual, family, and community characteristics. Some community level characteristics, such as the mean prevalence of disease, are calculated from individual-level data, and some, such as clinic accessibility, come from community-level surveys, when these surveys are available. Because the model is concerned with competition among siblings for scarce resources within households, we have included only children born in the survey window who have at least one surviving sibling. A large number of parameters are estimated in this study but only selected results will be presented here. A complete set of results is available from the authors.

Notable in an examination of descriptive statistics is the substantial degree of variation among surveys. For purposes of estimation, within-survey variation is vital. Table 1 illustrates the diversity among surveys. The proportion of births reported at the time of conception to have been unwanted (that is, those cases where the mother reports the child was desired neither at

conception nor at some later time) is very low in Indonesia, Tanzania and Uttar Pradesh; and very high in Bangladesh, Mali, and Nepal. In the spirit of Easterlin, Bongaarts (1997b) argues that as a society passes through the demographic transition, unwantedness should be expected first to rise, as family size preferences fall, and then to fall, as people employ fertility regulation. Figures 1 and 2 illustrate the variation in unwantedness and number of children among surveys.

Fever or cough apparently are very common symptoms in young children. We refer to these symptoms as acute respiratory infection (ARI), with the understanding that this set of symptoms is consistent with a wide range of other possible diseases. With the exception of Uttar Pradesh, one-third or more of children aged 0-4 were reported to have had one or the other in the two weeks preceding the survey. While in each setting, diarrhea prevalence is always lower than ARI prevalence, it is still high enough in every setting that children would reasonably be expected to have multiple diarrheal episodes in a year. Treatment for either condition is not uncommon, but certainly is far from universal in most settings. Figures 3 and 4 show that children in Tanzania have the highest incidence of illness.

Results

Our primary expectation was that unwanted children would force resource reallocations within the family, and therefore that children who were classified as unwanted by their mother would be more likely than others to suffer illnesses¹¹. As Table 2 shows, this expectation was borne out. This table reports the impact on the predicted probability of illness of a birth being wanted (in the first two columns) or of an additional sibling (the latter pair of columns). The estimated marginal effect of wantedness or number of children is first calculated from probit coefficient estimates. This yields the impact on the probability of becoming ill. To make the

results comparable, we divide the marginal effect by the mean probability of illness. These transformed results, which are interpreted as the percentage change in the probability of illness due to a change in unwantedness or the addition of one sibling, are reported in Table 2. The reported significance levels are based on the ratio of the estimated probit coefficient to its standard error.

As the first column of Table 2 and the accompanying Figure 5 show, children wanted at conception clearly are consistently less likely to display ARI symptoms than are unwanted children. The effects are sizable, and uniformly statistically significant, implying that unwanted births are from 10% to roughly 30% more likely to display ARI symptoms. A comparison of Figures 1 and 5 shows that with the exception of Bangladesh and Tanzania, there is a rough correspondence between the extent of unwantedness and the impact of unwantedness on ARI incidence, with the largest effects found where unwantedness is smallest. We conjecture that this may be because children reported as unwanted in a situation where unwantedness is not common are more strongly unwanted than those children reported as unwanted in societies where unwantedness is more commonly reported. That is, the former are those whose parents have strongly held family size preferences or tightly binding budget constraints.

The second column of Table 2 and Figure 6 show that wantedness is less uniformly associated with diarrheal disease than was the case with ARI. The impact is statistically significant in 7 of the 12 surveys, and in these instances, is uniformly larger than the impact of wantedness on ARI. However, in the three sub-Saharan African countries, Bangladesh, and Indonesia, the impact of wantedness on diarrheal disease incidence is small and statistically insignificant. The variability in impact does not seem to be related to the prevalence of diarrhea.

Figure 4 shows that Mali and Nepal, for example, have relatively high prevalence, while Egypt and Bangladesh have relatively low prevalence. Wantedness has an important effect on the probability that an individual child contracts diarrhea in Nepal and Egypt, but not Bangladesh or Mali.

The final columns of Table 2 show the impacts of number of children on ARI and diarrhea. Figures 7 and 8 present these results graphically. As was the case for wantedness, the ARI results are more uniform. In all but three surveys, the estimated coefficients are statistically significant, but positive, implying a benefit to child health of increasing numbers of surviving siblings. As we pointed out in our earlier discussion of the literature, this is not an uncommon finding, and our results on the Hausman-Wu test for endogeneity of number of children lead us to doubt that model misspecification accounts for the negative coefficients. The number of children impact is small, averaging roughly 20% the magnitude of the unwantedness effect on ARI, and 15% for diarrheal disease. This finding may signify that women with more experience in raising children (that is, whose children have larger number of siblings) are better able to protect their children from contracting an illness.¹²

Also included as covariates in the underlying regressions for either illness were, at the individual level: child's sex, age, and age squared; at the household and family level: mother's education and age, father's education, assets owned, and availability of water and toilet facilities; and at the sample cluster level, the areal prevalence of the disease in question. The marginal effect of areal prevalence was always positive, and almost always highly significant. The key family-level variables were family wealth, mother's education, and father's education, although none of these were significant in more than half of the possible (24) cases. In more instances

than not, male children were more likely to become ill (with the exception of Indonesia, where males were less likely to become ill with ARI). Incidence of either disease peaks around age two years.

Turning to treatment of ill children, we estimated probit models for the probability that a sick child received modern-sector care. Table 3 presents a summary of our results for wantedness and number of children¹³. The regression results for individual countries for both univariate probit and two-stage Heckman selection model are available from the authors. In the first column of data, and in Figure 9, one sees that the impact of wantedness on ARI treatment is much less clear-cut than is its impact on the incidence of disease. The majority of the effects have an unexpected negative sign, although only two of these are statistically significant. The second column of Table 3, and Figure 10, show that the situation is much the same regarding the treatment of diarrhea. While the majority of coefficients have the expected positive sign, only two are statistically significant, and three are negatively signed and significant.

The impact of number of children on treatment, at least of ARI, is more clear-cut. The third column of Table 3 and Figure 11 show that in 7 of 11 surveys with available data on ARI treatment, the impact of number of children is negative, statistically significant, and sometimes sizable.¹⁴ We estimate a linear number of children effect, which implies that each additional sibling decreases treatment probabilities by an equal amount. The final column of Table 3, and Figure 12, show that increasing number of children systematically diminishes treatment probabilities for diarrhea in only in only a few countries. Our conjecture is that this is in part because the accepted treatment protocol for diarrheal disease, administration of oral rehydration

salts, is an inexpensive, widely available method whose use typically makes no real resource demands.

A generalization of these results is that wantedness matters in predicting the incidence of disease, but not in subsequent treatment. Conversely, increasing number of children reduces the probability that a sick child receives treatment, at least when they show symptoms of ARI, but does not increase the incidence of illness. One possible explanation is that parents practice a sort of benign neglect toward the unwanted child (or possibly toward a larger subset of the family) in response to the resource pressure placed on the family by the birth of the unwanted child. However, faced with illness, parents respond without regard to wantedness status, within the constraints imposed by family size.

Also included as covariates in the underlying regressions for treatment of either illness were, at the individual level: child's sex, age, and age squared; at the household and family level: mother's education, father's education, assets owned, and an indicator variable for whether the mother sought prenatal care; and at the sample cluster level, the average reported travel time to the nearest health provision point. The peak age for treating either illness was roughly two years. Of eighteen possible instances, males were slightly favored in seven and disfavored in two. Mother's education increased receipt of treatment in less than half of cases, and father's education increased treatment in more than half. These results support Gursoy's (1994) conjecture that father's education is often important as mother's education. Higher family wealth was associated with increased likelihood of treatment in more than half of cases. In virtually all cases, family wealth was an important determinant of subsequent treatment of ARI symptoms. In virtually none was wealth an important determinant of diarrhea treatment. This pattern supports

our prior claim, that part of the reason that there is little systematic variation by number of children in diarrhea treatment was that oral rehydration does not place heavy resource demands on the household. Mother's use of prenatal care was almost always associated with increased probability of obtaining care for a child's ARI symptoms, but was associated only rarely with the probability of obtaining care for diarrhea. Average reported travel time to the nearest health provider, was almost never an important determinant of whether either sort of care was provided.

Table 4 and Figures 13 and 14 show that, in most settings, neither wantedness nor number of children is an important determinant of the number of vaccinations received. With the notable exceptions of Bangladesh, Mali and Nepal, the impact of either of our variables of interest is well under one vaccination per child. We estimate impacts of 5% or below, which, though typically statistically significant, are small in size. Since there are typically eight scheduled vaccinations and observed mean numbers of vaccinations are mainly near this level, one shot represents a 12.5% change, at a minimum. The lack of significance of number of children and wantedness in these countries may reflect the fact that childhood immunizations are administered as part of national campaigns in which immunization teams go from door to door or use town leaders to round up children for immunization. For the three countries where number of children and wantedness matter, the average number of vaccinations is less than 3, the impact of wantedness is very large, and the impact of number of children is positive, but much smaller in absolute value than is the effect of wantedness. If in these countries vaccinations are relatively difficult (expensive) to obtain, our results are credible.

Conclusions

If unwanted children or children from large families have worse health outcomes than wanted children or children from smaller families, family planning programs that provide the means to allow couples to have fewer births, to time and space these births, and to have fewer unwanted births can be justified in terms of their health benefits to women and children. Did we find grounds for such a justification? We found considerable evidence of worse health outcomes among unwanted children and less treatment for sick children in larger families where treatment involved the expenditure of scarce family resources. We found no evidence, all else constant, that children in larger families are more likely to become ill, and little evidence that unwanted children are less likely to receive medical care.

Children who were wanted had a lower incidence of ARI in all countries. The impacts were quantitatively large, from 10% to 30% of the mean incidence of ARI. Children who were wanted also had a lower incidence of diarrhea in seven of the eleven countries and one large Indian state we studied. Again, the effects were quantitatively large, increasing the prevalence of diarrhea in unwanted children by 15% to 50%. Unwantedness is widespread in developing countries. On average in the countries studied, 24% of children were reported as unwanted and in four countries more than one child in three was reported to be unwanted. Thus the adverse effects of unwantedness on child morbidity we have estimated affect a large number of children in the developing world. We did not find that children from larger families became ill more often than those from smaller families. In fact, we found the reverse. Perhaps this indicates that women with more experience in raising children are more able to shield them from disease.

In general, wanted children were no more likely than unwanted children to receive treatment for ARI or diarrhea once they were ill. However, children from larger families were less likely to receive treatment for their illnesses than were children from smaller families. In seven of eleven cases, number of children had a statistically negative effect on treatment for ARI and in two cases of ten for diarrhea. The differential in treatment between the two diseases may reflect the relatively high cost of drugs to treat respiratory infections, as compared to easily obtained oral rehydration salts for diarrhea. Having one more sibling decreased the likelihood of receiving treatment by from 2% to 8% of the average level of treatment, where statistically significant.

In countries where the level of vaccination is low, we found that wanted children receive 50% to 100% more vaccinations than unwanted children. However, in most countries, most children receive the full course of vaccinations.

In about half of the countries studied, children with more educated parents and from families with more wealth were less likely to become ill and were more likely to receive treatment. In six countries we found evidence of boys receiving more treatment than girls and in two countries girls received more treatment than boys.

The results suggest that imperfect fertility control generates a sort of benign neglect, where the birth of an unwanted child forces a reallocation of family resources which is disadvantageous to the unwanted child.. We do see some support for egalitarianism in our treatment results, as parents faced with sick children apparently do not discriminate against the unwanted child in seeking treatment. However, when that treatment is costly, children from larger families are less likely to receive treatment than are children from smaller families.

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Endnotes

¹ We experimented with separate variables for “wanted”, “wanted later”, and “unwanted”. The results for wanted and wanted later were very similar, so we decided that two categories, “wanted” and “unwanted” adequately describe the data.

² As John Casterline has pointed out to us, if unwantedness does decay over time, this means that some of the children reported at the survey date to have been wanted at the time of their conception would have been reported to be unwanted had the survey come earlier. If there are consequences to unwantedness, these children would have suffered them for some part of their lives. This blurs the distinction between wanted and unwanted children, making our estimates of the consequences of unwantedness conservative.

³ In our case, the two variables are illness and treatment, and selection into the treatment equation is determined by the illness variable.

⁴ Pitt (1997) reports similar difficulties in a model of fertility and mortality. Jensen and Ahlburg examined alternative specifications of the illness equations in great detail for the Philippines (Jensen and Ahlburg 1999). The treatment equation results there were robust to simple probit, bivariate probit with endogenous selection, and a linear Heckman selection model with heteroskedasticity correction.

⁵ The linear probability model is consistent, even with the Heckman λ as a covariate. It is inefficient, heteroskedastic (but in known fashion), and can yield predications outside of the unit interval. See, *e.g.*, van de Ven and van Pragg (1981).

⁶ For each illness, we first estimate the structural equation for morbidity, and then use the estimated parameters in constructing the inverse Mills' ratio term for the treatment equation.

⁷ Independence is likely to hold since parental competence is likely to reflect mainly innate qualities while family genetic characteristics are presumably determined by biological factors (Sastry 1997:259)

⁸ Ian Diamond, University of Southampton, and David Guilkey, University of North Carolina, have worked out the statistics of such models but the software is yet to be written to estimate them.

⁹ This is the only state with a sufficiently large sample for our purposes.

¹⁰ We are studying a fairly rare event by the time we reach the end of the behavioral chain. If one woman in two had a birth in the five year pre-survey window in which the information we need is collected, and of these, 1 in 10 were unwanted, of which 1 in 8 were to get ill, of which 1 in 2 were to be treated, only 1 in 320 sample points will contribute information about treatment, and 1 in 160 information on illness.

¹¹ DHS data are not well suited to the question of whether the burden is borne by the unwanted birth alone, or also spread out over a larger family group. The more egalitarian the fashion in which parents distribute resources, the more closely the morbidity experiences of other children will mirror that which

we observe for the unwanted child. This implies that the actual impact on child health of a reduction in unwantedness may be somewhat larger than direct effect on the unwanted child which we estimate.

¹² Desai (1995) explored interactions between sibsize and parental motivation. She found that in 4 of the 15 countries studies, the impact of sibsize was greater in families who had exceeded their desired family size. We ran interactions between sibsize and wantedness but the coefficients were not statistically significant.

¹³ It is possible that our two-week window of observation is not long enough to observe all treatments. Thus we may underestimate the average level of treatment, but there is no reason to expect this to bias the coefficients.

¹⁴ Desai (1995) added controls for birth order and birth spacing but found that they were statistically significant in less than a third of countries and incorrectly signed in a third of these cases. In addition, their inclusion did not affect the significance of sibsize. We did not include birth order and birth spacing or several reasons: first, they are arguably endogenous and the DHS data lacks sufficient variables for identification; birth order and birth spacing are largely a function of education and income (Sastry 1997) and these variables are in our model; and third, Desai has shown that they are not empirically important.

Table 1: Selected descriptive statistics

Survey	Fraction of births unwanted	Number of surviving children	Proportion reporting fever or cough	Proportion reporting diarrhea	Proportion with 'ARI' receiving treatment	Proportion with diarrhea receiving treatment	Sample Size
Bangladesh	0.51	3.03	0.37	0.13	0.24	0.23	4,335
Egypt 92	0.26	3.59	0.33	0.14	0.54	0.50	7,790
Egypt 95	0.20	3.50	0.54	0.17	0.50	0.46	9,769
Indonesia 91	0.05	2.35	0.35	0.10	0.83	0.78	14,267
Indonesia 94	0.07	3.03	0.35	0.11	0.56	0.53	14,821
Kenya	0.18	4.11	0.54	0.14	0.44	0.45	5,279
Mali	0.41	3.81	0.53	0.27	0.30	0.19	6,679
Nepal	0.50	3.19	0.57	0.29	0.18	0.15	5,180
Peru	0.37	3.43	0.55	0.20	0.37	0.32	13,962
Philippines	0.16	2.96	0.41	0.10	0.64	0.45	8,151
Tanzania	0.10	3.68	0.22	0.52	0.60	NA	1,418
Uttar Pradesh	0.11	3.23	0.22	0.08	NA	NA	8,213

Notes:

1. In Tanzania, every child was reported to have had either a fever or cough in the two weeks preceding the survey. The proportion reporting fever only is reported above, and used subsequently.
2. Data on treatment were not available for Uttar Pradesh, and no children were reported to have received diarrhea treatment in Tanzania.
3. Reported means are unweighted. Coverage in Indonesia changed to weight Outer Islands II more heavily, resulting in higher apparent fertility and lower treatment utilization in 1994 as compared to 1991.

Table 2: Impacts of wantedness and sibsize on disease incidence, by country

Country	Wantedness		Number of Children	
	ARI	Diarrhea	ARI	Diarrhea
Bangladesh	-0.29***	-0.12	-0.05***	0.02
Egypt 92	-0.12***	-0.31***	-0.08***	-0.08***
Egypt 95	-0.22***	-0.36***	-0.05***	-0.08***
Indonesia 91	-0.21***	-0.38***	-0.03***	-0.04***
Indonesia 94	-0.23***	-0.01	-0.04***	-0.01
Kenya	-0.17***	-0.05	-0.05***	-0.04
Mali	-0.11**	0.04	-0.03***	-0.01
Nepal	-0.09**	-0.25**	-0.03**	-0.03
Peru	-0.09***	-0.12***	-0.02	0.01
Philippines	-0.15***	-0.18*	0.00	-0.03*
Tanzania	-0.32***	0.11	0.00	0.00
Uttar Pradesh	-0.23***	-0.38***	-0.04*	-0.03

Notes:

1. ***, **, and * denote statistical significance versus two-tailed alternatives at 1%, 5% and 10% levels.

Table 3: Impacts of wantedness and sibsize on disease treatment, by country

Country	Wantedness		Number of Children	
	ARI	Diarrhea	ARI	Diarrhea
Bangladesh	-0.05	-0.84**	-0.06*	-0.13**
Egypt 92	-0.07	0.01	-0.02*	0.01
Egypt 95	-0.17 ***	0.02	-0.03***	-0.03
Indonesia 91	-0.02	0.17**	0	-0.01
Indonesia 94	0.002	-0.16*	-0.002**	-0.004***
Kenya	-0.02	0.35**	-0.02	-0.01
Mali	0.03	-0.95***	0.02	0.02
Nepal	-0.02	-0.13	-0.08**	-0.08
Peru	0.05	0.05	-0.01	0.01
Philippines	-0.05	0.05	-0.02**	-0.04
Tanzania	0.03	NA	-0.16***	NA
Uttar Pradesh	NA	NA	NA	NA

Notes:

1. ***, **, and * denote statistical significance versus two-tailed alternatives at 1%, 5% and 10% levels.
2. Reported means are unweighted. Coverage in Indonesia changed to weight Outer Islands II more heavily, resulting in higher apparent fertility and lower treatment utilization in 1994 as compared to 1991.
3. Data on treatment were not available for Uttar Pradesh, and no children were reported to have received diarrhea treatment in Tanzania.

Table 4. Determinants of number of vaccinations, by country

<u>Country</u>	<u>Mean</u>	<u>Marginal Effect/Mean</u>	
		<u>Wantedness</u>	<u>Number of Children</u>
Bangladesh	3.055	1.2***	0.44***
Egypt 92	6.429	-0.04***	-0.02***
Egypt 95	6.655	-0.03***	-0.01***
Indonesia 91	2.38	-0.02	-0.01***
Indonesia 94	5.200	-0.05***	-0.04***
Kenya	6.892	-0.01	-0.01***
Mali	2.565	1.28***	0.24***
Nepal	2.791	0.48***	0.02**
Peru	7.144	0.02***	-0.001
Philippines	5.92	0	-0.02
Tanzania	6.677	-0.05**	0
Uttar Pradesh	NA	N/A	N/A

1. ***, **, and * denote statistical significance versus two-tailed alternatives at 1%, 5% and 10% level

Figure 1. Mean Unwantedness

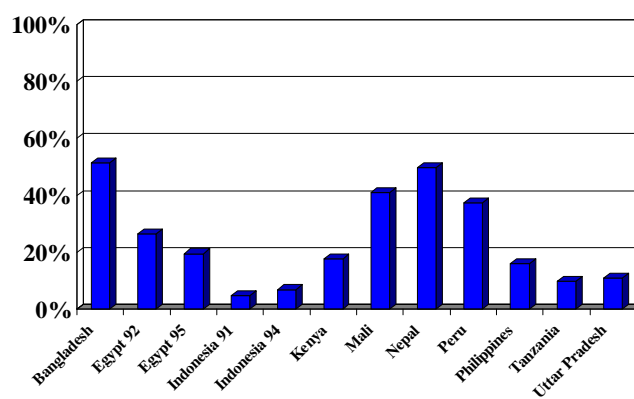


Figure 2. Mean Number of Children

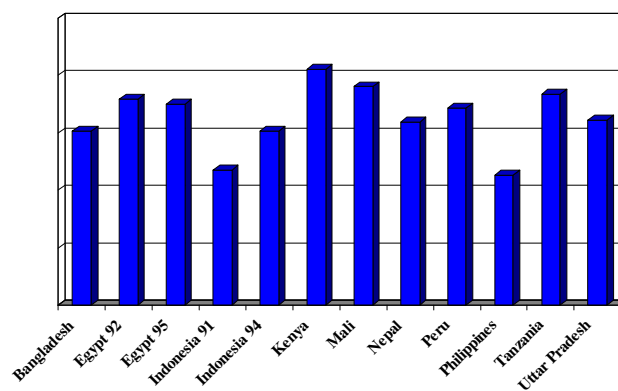


Figure 3. ARI prevalence

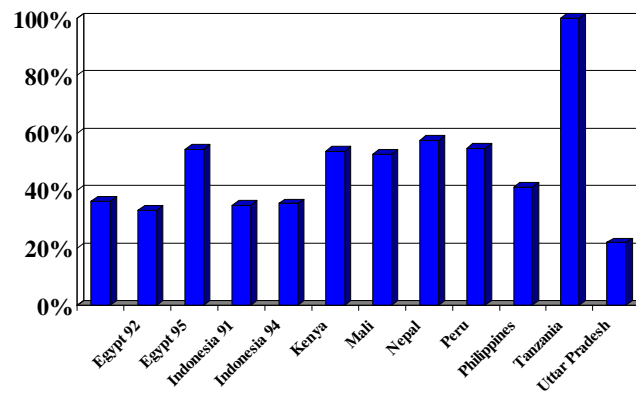


Figure 4. Diarrhea prevalence

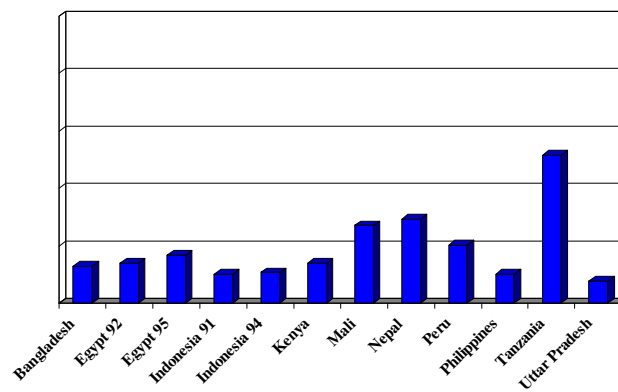
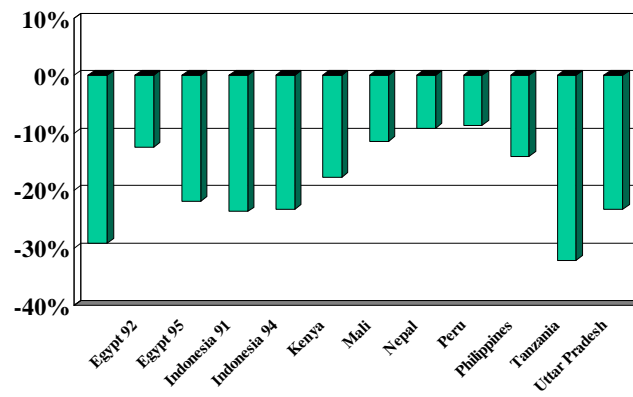
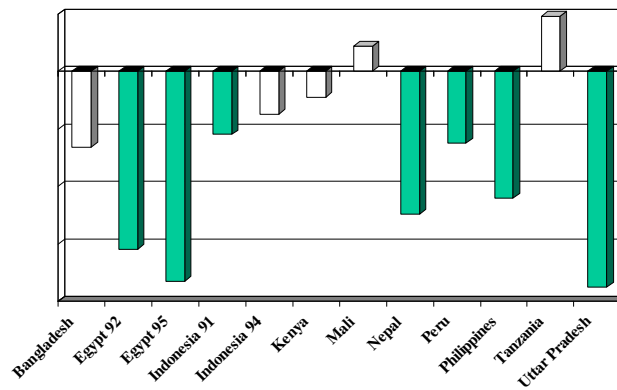


Figure 5. Impact of wantedness on ARI morbidity, in percent



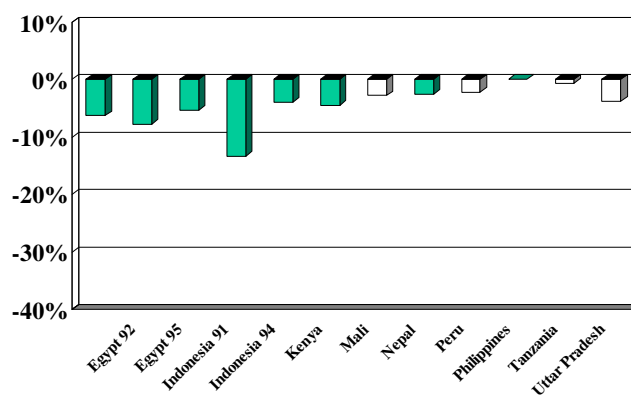
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 6. Impact of wantedness on diarrhea morbidity, in percent



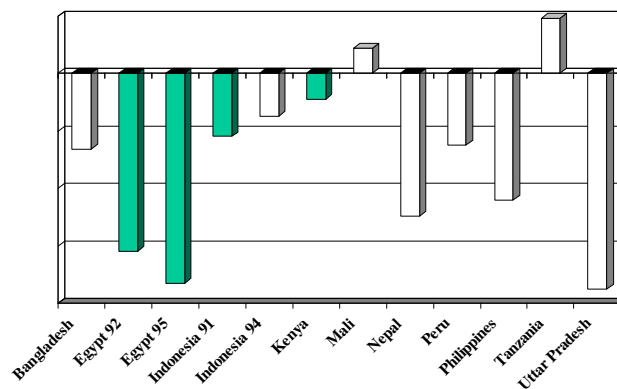
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 7. Impact of number of children on ARI morbidity, in percent



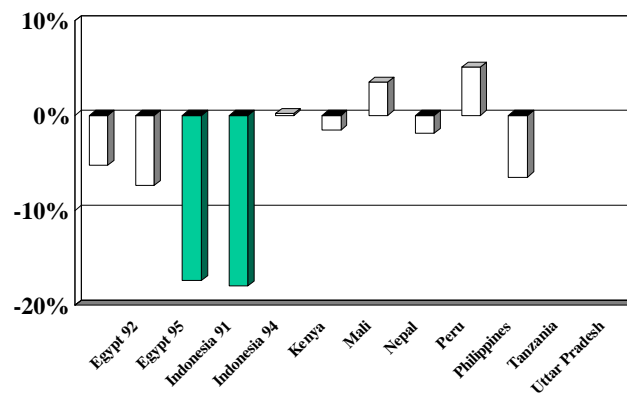
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 8. Impact of number of children on diarrhea morbidity, in percent



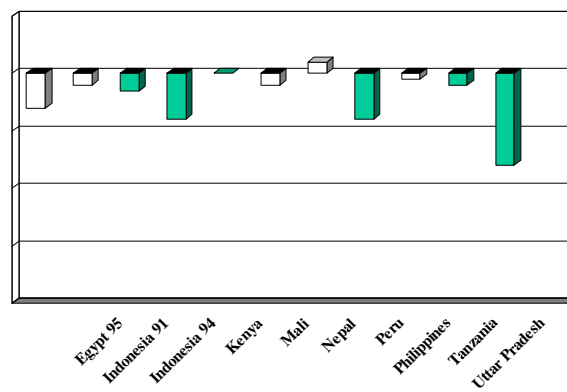
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 9. Impact of wantedness on ARI treatment, in percent



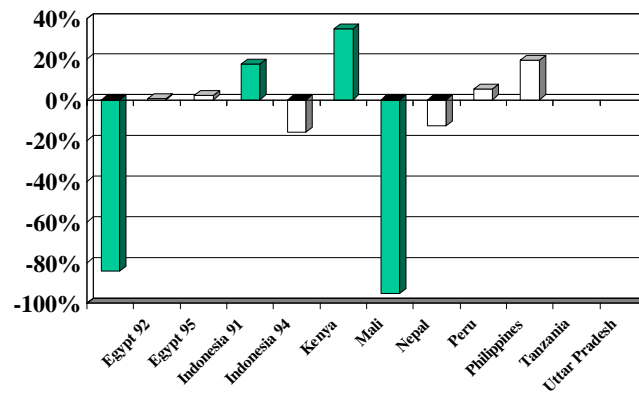
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 10. Impact of number of children on ARI treatment, in percent



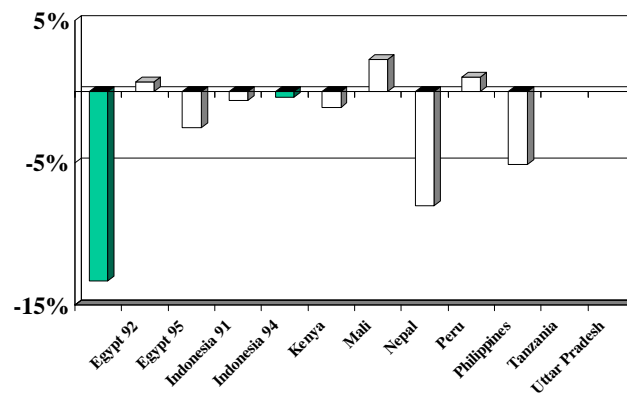
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 11. Impact of wantedness on diarrhea treatment, in percent



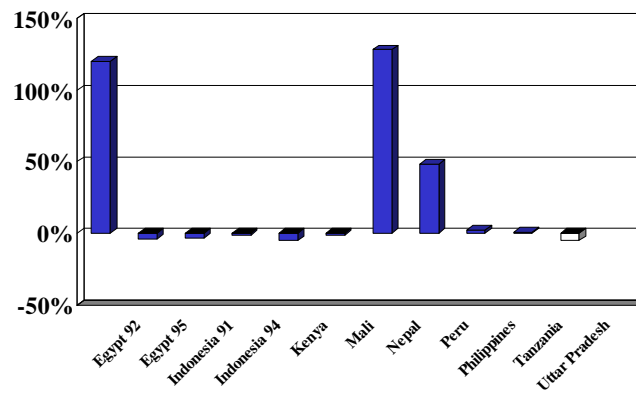
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 12. Impact of number of children on diarrhea treatment, in percent



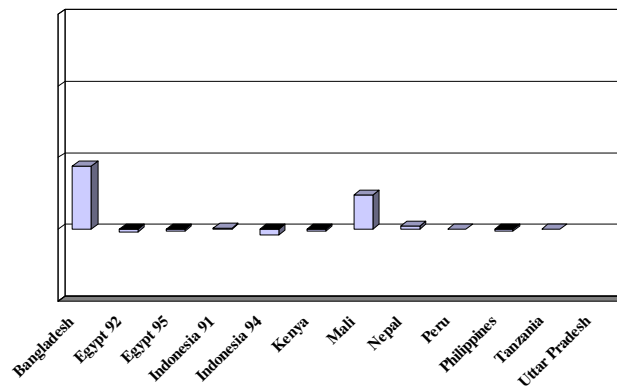
Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 13. Impact of wantedness on vaccination, in percent



Note: Shaded bars denote $p < .05$ for the underlying coefficients.

Figure 14. Impact of number of children on vaccination, in percent



Note: Shaded bars denote $p < .05$ for the underlying coefficients.